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growth in rich soil. Were this the case *Humulus* would mean 'little moist earth,' a nonsensical name to apply to a plant.

Du Cange, in his Glossarium mediæ et infimæ Latinitatis gives the forms *humlo*, *humulo*, *humelo*, *humolo*, *humulus*, and, under one of them, says, "ex Gall. *houblon*, quod a Latino *lupulum* formatum, elisa litera *l*."! This, although pretty bad etymologizing, was good enough for the period at which it was put forth, and is of value as showing that Du Cange considered these low Latin words as borrowed from a living language, as is indeed the case. They are probably, as Skeat (Etymol. Dict.) states, of Teutonic origin (O. Du. *hommell*, O. Norse *humall*, Swed., Dan. and Norweg. *humle*), although similar names for the hop are to be found in the Slavonic dialects, and in Finnic and Tartaric. Other Teutonic names for the hop are: O. H. Ger. *hopfo*, M. H. Ger. *hopfe*, *hoppe*, Ger. *hopfen*, Flem. *hoppe* (whence O. Eng. *hoppe*, Eng. *hop)*, Du. *hop*. Skeat would connect these two forms, and derive the latter from the Aryan root *kap*, 'to undulate,' 'bend,' in allusion to the twining nature of the plant, and the former from this same root nasalized—*kamp*.*

W. R. G.

Botanical Notes.

The Coloration of Autumn Leaves.—Mr. H. C. Sorby, who has for several years been studying the subject of the coloration of autumn leaves, gives (in *Nature*) the following conclusions in regard to it.

As a general rule the color of leaves in their normal condition depends on a variable mixture of two perfectly distinct green pigments and of at least four perfectly distinct yellow substances. The development of the autumnal tints is mainly due to the disappearance or change of the green constituents and to the production of highly-colored pigments by the oxidization of previously existing very pale or colorless substances. It is, in fact, due to a more or less complete loss of the vitality which previously counteracted these chemical changes, and the order in which the tints are developed can be easily explained, if we assume that the death of the leaves takes place somewhat gradually. The first visible effect of the reduced vitality is the change in the green pigments. In many cases they appear to be converted into colorless products, since the resulting bright yellow leaves differ from the normal green in the absence of chlorophyll, and merely contain the usual previously existing yellow pigments. At the same time it is quite possible that an increased quantity of some of these yellow substances may be formed as a product during the change, but of this there is no positive proof. In the case of such trees as the alder, the chlorophyll does not thus dirappear, but is changed by the presence of a weak acid into a very stable brownish-green product which resists further change. The production of bright yellows or dull browns thus clearly depends on whether the chlorophyll does or does not disappear before being modified by the action of acids, as may be verified experimentally by exposing suitable solutions to sunlight. It is, however, very clear that the manner in which it changes depends very much on the conditions of the case. Thus, if chlorophyll is exposed to sunlight dissolved in bisulphide of carbon, a reddish-colored product is formed, and, though this differs very greatly from the red pigment met with in many autumnal leaves, it seems probable that under some conditions the chlorophyll in leaves is changed by the action of light into a red substance. By taking green sorrel leaves and keeping them somewhat fresh by sticking the stalks into moist ground, I found that those exposed to the sun with the under side upwards turned to a bright red, whereas those kept in the shade did not develop any fine coloring. We may often see that partially broken leaves or twigs undergo this change when all other parts of the tree remain green, and this and various other facts lead me to conclude that the change of chlorophyll into a red product depends on a certain amount of reduced vitality as well as on little-understood conditions varying in different kinds of plants. Though I fully admit that there are some facts not easy to understand, yet on the whole it seems to me that these principles fairly well explain why certain leaves turn red in autumn. Slight frosts reduce their vitality in such a manner that the chlorophyll is changed by the action of the light into a red product. Thus, according to the character of the season and the nature of the plants, the first effect of the reduced vitality in the leaves is that the chlorophyll is removed so as to show their normal yellow color, or is changed into a red pigment, or is altered into a comparitively stable dull brown-green product. These are the three extreme changes, but in many cases intermediate mixed results give rise to such less perfect and well-marked tints as dirty yellows and reds.

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* It is well to note here, however, that Nemnich (Allgemeines Polyglotten Lexicon der Natur-geschichte) gives *hymel* as the Persian name of the plant.

The next series of changes is best studied in the case of those leaves which in the first instance turn to a bright yellow, and it appears to me that they depend mainly, if not entirely, on the production of deeply-colored pigments by the oxidization of tannic acid and other more or less colorless substances. The difference in the resulting tint seems to depend on the nature these substances. Thus, for exemple, the tannic acid in the yellow oak leaves changes into a brown substance, whereas the quinotannic acid in yellow beech leaves changes into the fine orange-brown color which makes those trees so ornamental in autumn. On the contrary, the bright yellow poplar leaves rapidly pass to a dark dirty brown by the alteration of another constituent. Other kinds of leaves give rise to tints of an intermediate and less well marked character. In many cases it is almost impossible to draw the line between the color of this stage in the change and the final dark and dirty browns of dead and decaying leaves. For fine effect very much depends upon the production of each special tint in a fairly pure state, so as to show bright yellows, reds and browns. This seems to be influenced by the character of the weather. It is also, of course, important that the half dead leaves should hang long on the trees, so as to develop their full coloring before being blown off by the wind.

Taking thus all the facts into consideration, it appears clear that all the bright and beautiful tints of autumn are merely the earliest stages of decomposition, and are due to the more or less considerable triumph of chemical forces over the weakened or destroyed vitality of the living plant. One cannot but feel that this is a very unpoetical way in which to regard the magnificent tints of a fine autumnal landscape, but it is no less true than that the colored clouds of evening mark the departing day.

Botanical iterature.

Memorial of George Bentham. By Asa Gray. (Reprinted from the *American Journal of Science*, xxix.)

Flora of Southern and Lower California. A Check-list of the Flowering Plants and Ferns. By Chas. R. Orcutt. 8vo., pamph., pp. 13. San Diego, Cal., 1885.

Marine Algæ of San Diego, Cal. By Daniel Cleveland.

Memorial of George Bentham. By Asa Gray. (Reprinted from the *American Journal of Science*, xxix.)

Proceedings of the Torrey Club.—The regular meeting of the Club was held at Columbia College, Tuesday evening, January 13th, 1885. In the absence of the presiding officers, Dr. Britton occupied the chair.

This being the Annual Meeting, officers for the ensuing year were balloted for with the following result: President, J. S. Newberry; Vice President, Addison Brown; Treasurer, W. H. Rudkin; Recording Secretary, Arthur Hollick; Corresponding Secretary, Miss Maria O. Steele; Editor, W. R. Gerard; Associate Editor, Benj. Braman; Curator, Miss E. G. Knight; Librarian N. L. Britton.

Miss Knight announced that she had recently detected *Azolla Caroliniana* growing luxuriantly in the water-lily tanks of a greenhouse on Staten Island.

Dr. Britton exhibited specimens of *Dioclea Boykinii* lately collected in Arkansas by Prof. F. L. Harvey, and also a new species of *Cyperus* (described in the January BULLETIN) from S. Arizona.

Mr. Schrenk read a paper upon the structure of *Limnanthemum lacunosum*, (see page 13.)

At the regular meeting of the Club, Tuesday evening, Feb. 10th, the chair was occupied by Dr. Britton in the absence of the presiding officers, and sixteen persons were present.

The chairman gave a brief account of the difference between *Stellaria longifolia* and *S. graminea.* The latter has often been mistaken for a variety of the former and appears to be spreading. Specimens were shown from localities on Long Island, Staten Island and the Newark Mountains.

Mr. Schrenk remarked upon the presence of peculiar hairs in the intercellular canals of *Brasenia peltata*, and which are quite different from those found in *Nymphæa* and other aquatic plants.

Two persons were elected active members.